

# Plain Talk and Technical Tips

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## CTC 40 Training Program

The latest in the continuing series of training programs is being presented now by the RCA Consumer Electronics Distributors. Dealing with the all-solid-state (except high-voltage rectifier) CTC 40 chassis, the program is divided into two parts. The first part of the program consists of a slide-and-lecture presentation which explains in detail the solid-state chassis. This lecture is being presented to large groups, 50 to 150 technicians, principally in evening meetings. Containing 144 slides, the program places emphasis on those circuits which differ from those in earlier models, although every circuit area is covered. A 108-page, 8-1/2" x 11" book is being distributed at the lecture meetings. Entitled "Solid State Color Television," this copiously illustrated book describes the CTC 40 circuitry in detail.

The second part of the CTC 40 training program consists of a workshop, similar in format to the CTC 38 program. There are a total of 20 flip charts: five on chroma; four on the horizontal-deflection and high-voltage system; three on vertical

Continued on Page 4



Figure 1—CTC 40 Training Meeting Room

## CTC 40 Combination Remote Instruments

CTC 40 combination/remote instruments utilize two DC relays to perform most of the power and signal switching functions necessary to use the radio/phonograph (stereo) amplifier for the television audio system.

A simplified schematic of the power and switching circuits and the interconnecting wiring is illustrated in Figure 2. The reader should note, in referring to this schematic (shown in T.V. OFF mode) the basic switching functions necessary to utilize the stereo amplifier for television audio.

1. Apply power to television chassis.
2. Apply power to stereo amplifier.
3. Disconnect power from radio tuner (to prevent tuner interference with TV reception).
4. Disconnect power from tuner pilot lamps (to prevent customer confusion).
5. Switch amplifier right and left channel inputs from radio tuner to television audio source.

The physical and electrical requirements of a motor driven rotary multipole switch to accomplish the above switching functions prohibits the use of such a switch.

Instead two DC relays perform all the power and audio switching functions with the exception of the application of AC power to the television receiver. This function is accomplished by a motor controlled rotary switch.

Referring to Figure 2, power is applied to the television receiver power transformer through the circuit breaker (CB101), the AC master power switch (S103), the motor controlled rotary power switch S1001B, located on the TMA, and the hi-low line voltage switch, S104A. Full line voltage is applied to the picture tube filament transformer via S1001A which bypasses the 680 ohm "instant pic" resistor, (R113).

When power is applied to the television chassis, relays K101 and K102 are energized by the TV chassis 155V DC supply. Contacts 5 and 6 of the power switching relay (K101) then close, applying

Continued on Page 2



## CTC 40 Combination Remote Instruments

Continued from Page 1

power to the radio power transformer; contacts 1 and 2 open, disconnecting tuner pilot lamp power, and contacts 7 and 8 open, to disconnect DC from the power supply regulator transistor which provides radio tuner power.

At the same time, the contacts of the double-pole-single-throw audio switching relay (K102) disconnect the left and right channel stereo predrivers from their respective loudness controls and connect the output of the television audio preamplifier to both stereo amplifier predriver bases.

The television audio preamplifier is a PNP transistor (type 3592) that is mounted on a terminal bracket located at the side of the television on-off volume control/switch. The television preamplifier circuit is an emitter follower which provides the proper impedance match between the preamplifier portion of the integrated circuit (IC 301 B) and the stereo amplifier predrivers. The driver section of the integrated circuit (IC 301 C) is not used.

The circuit components values used with the preamplifier transistor depend on the radio tuner chassis employed in the combination. The radio

tuners used are the RC 1223 or RC 1218. Power for the preamplifier transistor is derived from the radio tuner-amplifier power supply (-16V, RC 1223 or -18V, RC 1218). The utilization of the tuner-amplifier power supply minimizes the audibility of switching transients.

To further minimize switching transients, zener diodes are placed in series with the 155V DC supply to both power and switching relays to properly "sequence" relay de-energization (drop-out). This circuit refinement acts to eliminate "popping" when the instrument is turned off. A 30 volt zener diode in series with the DC supply to the K102 relay coil causes this relay to "drop-out" before K101. The 15 volt zener in series with the supply to the K101 coil acts to equalize the drop-out variations between the two relays, assuring that K101 will drop-out when the supply decreases to 15V. Capacitor C133 (10  $\mu$ F) across the K101 coil causes some "lag" in the drop-out of K101, further assuring proper sequencing.

The signal switching relay (K102) is mounted on the TMA in all instruments with the exception of the model HL 872. In this model K102 is mounted under the 1218 tuner. The power switching relay K101 is mounted to the cabinet in all instruments.

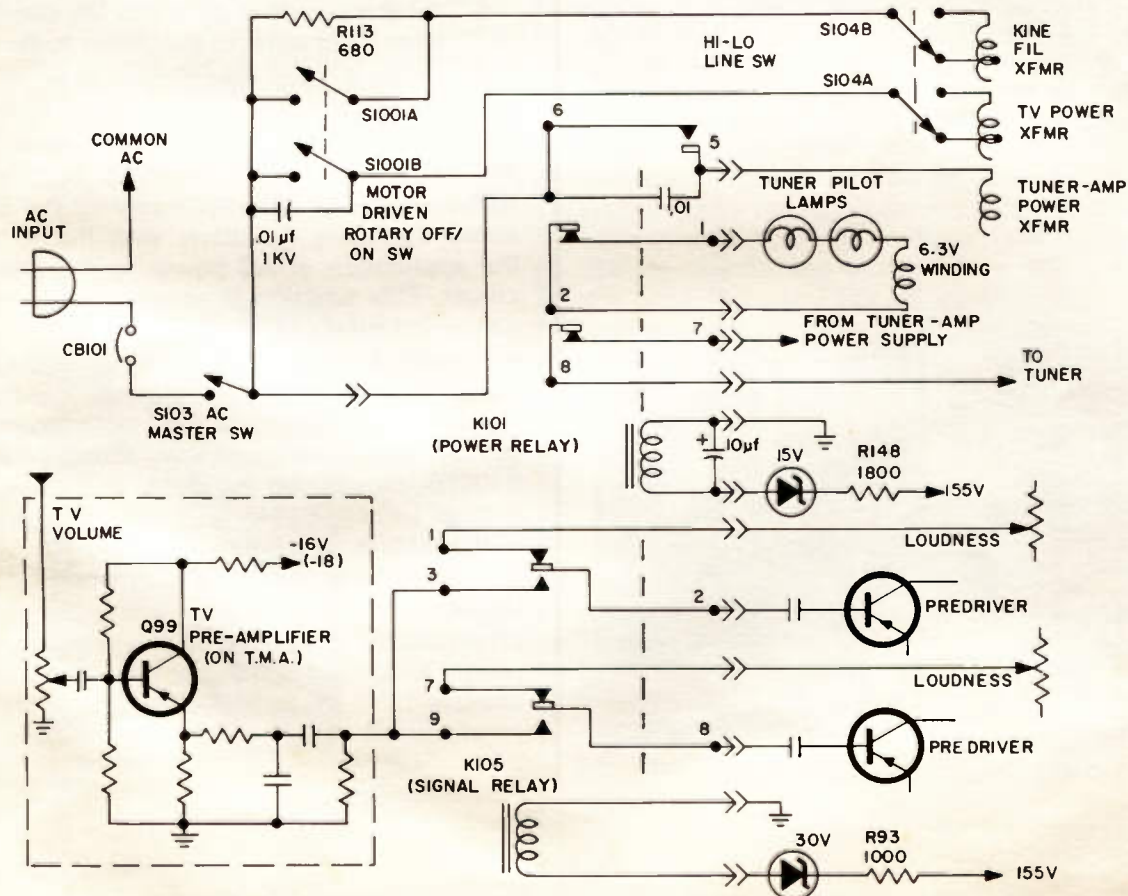


Figure 2—CTC 40 Combination Remote Switching (TV-OFF Position)



## Solid-State Blocking Oscillator

Although the operation of a transistorized blocking oscillator is similar in most respects to the operation of the vacuum-tube counterpart, an examination of the solid-state circuit still is warranted. Figure 3 illustrates the basic circuit.

For the sake of discussion, assume that  $B+$  has just been applied. The transistor is slightly forward biased by the large resistance between the base and  $B+$ , allowing it to conduct, causing a voltage drop across the primary of T1 (collector transformer). This drop is transformed to a positive-going voltage in the secondary which drives the transistor base further positive. The base current is substantial during this time, charging C1.

When current saturation (collector) is reached, the magnetic field in T1 can increase no more and the secondary voltage falls towards zero. This allows C1 to begin discharging through R1 to  $B+$ , causing the transistor base to be driven negative. This cuts off collector current, allowing the collector voltage to return to  $B+$  potential and also driving the base to its maximum negative voltage.

The charging path for C1 has very little resistance but the discharge path through R1 has high resistance. Therefore, the transistor is biased below cutoff for an appreciable length of time which depends on the RC time constant of R1 and C1. When enough of the charge on C1 has leaked off to allow the transistor base to resume conduction, the entire process is repeated.

Several modifications of the basic circuit normally are made to improve overall performance. A typi-

cal horizontal blocking oscillator circuit incorporating these changes is shown in Figure 4.

In the basic circuit, there are but two windings in the transformer, and the output is taken from the collector. A third secondary winding often is used to provide the output, particularly if a positive pulse is required.

The output of a blocking oscillator characteristically has rapid rise time, a spiked crest, and equally rapid decay. Sharp rise time normally is desirable, but it usually is necessary for the output pulse to have a flat top. This may be accomplished by inserting a suitable delay network between the pulse transformer and the transistor base. By using a resonant circuit, C1 may be made part of the delay circuit. By choosing the correct resonant frequency, the rise time of the output remains short, but the negative-going signal fed back to the base is delayed until the resonant circuit has completed about one-half cycle. As a result the device remains in saturation for the desired period, producing a flat-topped output.

The base waveform in Figure 3 shows that between pulses the base voltage rises along an exponential curve. Since the amount of rise per unit of time is relatively small at the time when the base is approaching its conduction point, minute variations in bias voltage, short-time variations in component values, stray fields etc. may cause slight shifts in frequency called pulse jitter. This may be eliminated by modifying the base voltage so that it rises rapidly into conduction. A parallel resonant circuit tuned slightly above the oscillator

Continued on Page 4

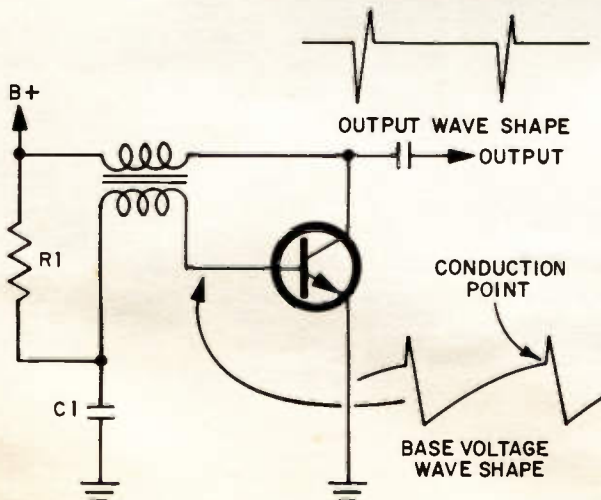


Figure 3—Basic Blocking Oscillator

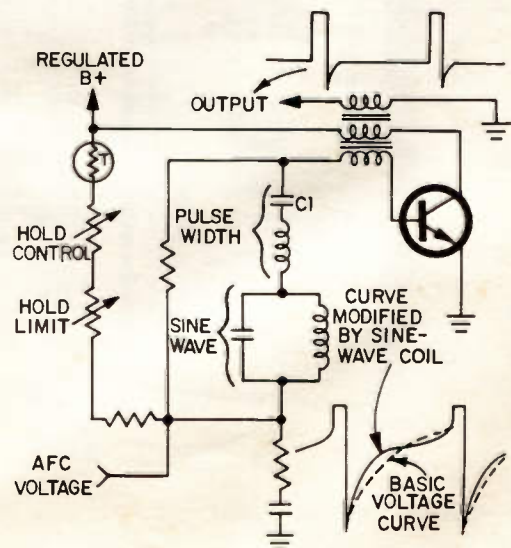


Figure 4—Horizontal Blocking Oscillator

## WC-506A Transistor/Diode Checker

Many Distributors are now offering the new RCA WC-506A Transistor/Diode Checker. This easy to use instrument provides quick go- no- go transistor and diode checks, making it handy to use when servicing solid-state instruments.

The tester offers two basic checks, gain and leakage. The self-contained meter is equipped with two scales; a go- or no- go gain measurement scale (red-green) and a relative leakage scale that is calibrated zero to 10.

The instrument is equipped with a universal panel mounted socket to facilitate quick checking of nearly any type small signal transistor.

In addition to the transistor socket, color coded leads with test clips are also provided to permit checking transistors which can not be inserted in the socket—such as power transistors.

A panel switch (for polarity reversal) permits measurement of both PNP and NPN transistor types. The same switch is utilized to check the forward and reverse characteristics of diodes. These are checked by inserting the diode in a spring clip holder.

The operation of the instrument is quite simple, in keeping with the quick-check nature. A transistor to be tested is inserted in the socket or connected to the external leads, and the switch is set for NPN or PNP depending on transistor type. Another switch (normal/high) is set to "normal" for low or medium power devices, to "high" when checking power transistors. Leakage of the unit under test is now indicated on the bottom scale.

If the transistor passes the leakage test, gain can be quickly tested by pushing down the "leakage/gain" button and noting the relative gain on the top scale.



Figure 5—WC-506A Transistor Tester

## CTC 49 Training Program

Continued from Page 1

deflection; two each on the AGC and video systems; and one each on the tuner, AFT, sync separator, and power supply. The flip charts are designed to allow service technicians to "learn by doing" the latest servicing and trouble-shooting techniques.

Reduced-size copies of the flip charts, with suggested servicing procedures printed on the facing pages, will be passed out at the workshop meetings. Also included in the program is a test and certificates of completion.

Complete information on how to participate in this Technical Training Program is available from RCA Consumer Electronics Distributors.

## Solid-State Blocking Oscillator

Continued from Page 3

frequency may be connected between base and ground to change the base-voltage waveshape as shown in Figure 4—to make the frequency more stable.

The frequency of a blocking oscillator may be controlled (within limits) by varying the voltage supplied to the bias resistor. By making this voltage more positive, the base returns to the forward-bias point more quickly and frequency is increased. If it is made less positive, the frequency will decrease. In a horizontal-oscillator application, the correcting voltage which is derived from the horizontal AFC system is added to the base bias voltage to achieve automatic frequency control of the oscillator.

The hold control and hold-limit control in Figure 4 allows the oscillator to be adjusted to the correct frequency by changing the RC time constant of the base circuit. Once this frequency is set near 15, 750 Hz, the control voltage from the AFC circuit will hold the oscillator in synchronism with the horizontal sync pulses.

## RCA Sales Corporation

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Product Performance—Technical Training

600 North Sherman Drive  
Indianapolis, Indiana 46201